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EXAMINER	
XU, KEVIN K	

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2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/784,112	LIAO ET AL.	
	Examiner	Art Unit	
	Kevin K. Xu	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 April 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11 and 13-17* is/are rejected.

7)☒ Claim(s) *12 and 18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 4/12/07 have been fully considered but they are not persuasive. Specifically applicant has argued that Ewins fails to teach "wherein only one level of texture level is stored and used to generate the lower resolution texture array." Examiner respectfully disagrees. Ewins explicitly teaches the texture filtering process utilizes "progressive averaging groups of four neighboring texels to form each new layer of the image pyramid. (Fig. 3) This process is continued from the initial, full detail, or base texture level, referred to as level 0, until the final single texel level is reached...." (Fig. 3, p. 318-319 Section 1.1) In other words, Ewin teaches texture filtering via an image pyramid or Mip-Map wherein an initial, full detail, base texture level (level 0 in Fig. 3) is stored and used to generate a lower resolution texture array (by averaging groups of four neighboring texels of level 0 to form the next layer of the MIP-map, level 1). In other words, if there are two levels 0 and 1, only level 0 (base level) is stored and used to form ("to generate") level 1.

Regarding applicant's amendment of "level of detail being derived only from the short axis, " Examiner will rely upon Percy (6292193) to teach this limitation. See Below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry. (6292193)

Regarding claim 1, Ewins ('133) teaches mapping a target pixel needing texture in a texture array, a region of support in the texture array being defined by a long and a short axis and being generally elliptical and a level of detail being derived from the short axis. (p. 1 paragraph 17- p. 2 paragraph 23, p. 2-3 paragraphs 35-41, Fig. 1A) It should be noted that Ewins ('133) teaches **tri-linear MIPmap filtering** wherein the LOD parameter is based on an interpolation which is a function of both major-axis and minor axis (short axis) minification. It should further be noted that Ewins ('133) teaches texture minification, which is quickly reducing the sampling density in a stored texture map to get data required for the screen. (p. 2 paragraph 17) However, Ewins ('133) does not *explicitly teach* texture minification involves a higher resolution texture array and performing a filtering function using texels from higher resolution texture array to simulate a filtering effect of using texels from higher resolution texture array and a second texel array having lower resolution, wherein only one level of texture level is stored and used to generate the lower resolution texture array. This is what Ewins teaches. (p. 318, Section 1.1) It should be noted that Ewins teaches the term MIP refers to prefiltering and storage of multiple texture maps of **decreasing resolution** (Fig. 3) and that this process is continued form an initial, full detail or base texture level referred to as level 0 (Fig 3), until the final single texel level is reached by progressively

averaging groups of four neighboring texels to form each new layer of the image pyramid. (Fig. 3 p. 318 Section 1.1) Thus, Ewin teaches texture filtering via an image pyramid or Mip-Map wherein an initial, full detail, base texture level (level 0 in Fig. 3) is stored and used to generate a lower resolution texture array (by averaging groups of four neighboring texels of level 0 to form the next layer of the MIP-map, level 1) Furthermore Ewins teaches texture minification is represented by each layer (Fig. 3) and is based on texture dimensions (changing resolution). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of a filtering function from higher resolution texture array to simulate filtering effect of using texels from higher resolution texture array and a second texel array having a lower resolution into the system of Ewins ('133) because filtering algorithms that utilize prefiltered texture storage can reduce cost of per-pixel texture accesses during filter construction and reduce time consumption. (p. 318 Section 1.1) Regarding the recitation of "wherein simulating filtering effects reduces the number of cache memory cycles associated with the filtering function", it may be understood that the filtering function of Ewins does produce this effect as the current claim language does not require reducing number of cache memory cycles in comparison to another filtering algorithm. Nonetheless neither Ewins ('133) or Ewins, explicitly teaches deriving LOD from only the short axis. This is what Perry teaches. (Col 8 lines 1-36) It should be noted that Perry teaches length of the minor axis determines the appropriate LOD. It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of level of detail derived from the short axis in

performing anisotropic mip-mapping into the system of Ewins because increasing the area covered by a space-invariant filter that is used to sample texture data at sample points (Col 3 lines 34-40) can be realized and performing anisotropic texture mapping that can vary attributes of a filter according to project pixel filter footprint and produce clearer images without introducing aliasing artifacts can be achieved, and thus, better anti-aliasing can be realized.

Claims 2-3, 6-8,10, 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry (6292193) and Rosman (6184894).

Regarding claim 2, The teachings of Ewins ('133) and Ewins are given in the previous paragraphs of this office action. Rosman teaches interpolating texels from higher resolution texture array to form a first blended texel, interpolating the texels from lower resolution texel array to form a second blended texel and interpolating the first blended and second blended texels to arrive a texture for the target pixel. (Col 2 lines 20-41, Fig. 3) It should be noted that Rosman teaches tri-linear interpolation. It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of trilinear interpolation into the system of Ewins because tri-linear interpolation helps eliminate artifacts such as abrupt, noticeable changes in image sharpness that can occur as the next LOD map is selected. (Col 2 lines 17-20)

Regarding claim 3, Ewins teaches filtering adjacent texels in the higher resolution array based on the mapped position of the target pixel in the higher resolution texture array to derive texels in the lower resolution texel array. (Fig. 3 p. 318 Section 1.1) It

should be noted that Ewins teaches the term MIP refers to prefiltering and storage of multiple texture maps of **decreasing resolution** (Fig. 3) and that this process is continued form an initial, full detail or base texture level referred to as level 0 (Fig 3), until the final single texel level is reached by progressively averaging groups of four neighboring texels to form each new layer of the image pyramid. (Fig. 3 p. 318 Section 1.1) Furthermore Ewins teaches texture minification is represented by each layer (Fig. 3) and is based on texture dimensions (changing resolution). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of filtering adjacent texels in the higher resolution array to derive texels of a lower resolution into the system of Ewins ('133) because filtering algorithms that utilize prefiltered texture storage can reduce cost of per-pixel texture accesses during filter construction and reduce time consumption. (p. 318 Section 1.1)

Consider claim 6, Ewins teaches averaging adjacent pixels texels in the higher resolution array based on the mapped position of the target pixel in the higher resolution texture array to derive texels in the lower resolution texel array. (Fig. 3 p. 318 Section 1.1) It should be noted that Ewins teaches the term MIP refers to prefiltering and storage of multiple texture maps of **decreasing resolution** (Fig. 3) and that this process is continued form an initial, full detail or base texture level referred to as level 0 (Fig 3), until the final single texel level is reached by progressively **averaging groups** of four neighboring texels to form each new layer of the image pyramid. (Fig. 3 p. 318 Section 1.1) Furthermore Ewins teaches texture minification is represented by each layer (Fig. 3) and is based on texture dimensions (changing resolution). It would have been

obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of filtering adjacent texels in the higher resolution array to derive texels of a lower resolution into the system of Ewins ('133) because filtering algorithms that utilize prefiltered texture storage can reduce cost of per-pixel texture accesses during filter construction and reduce time consumption. (p. 318 Section 1.1)

Regarding claim 7, Rosman teaches bilinearly interpolating adjacent texels based on the mapped position of the target pixel in the higher resolution array. (Col 1 lines 18-38, Fig. 1, Col 2 lines 20-41, Fig. 3) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of bilinear interpolation of Rosman into the system of Ewins because u,v coordinate values calculated may not be exact integer values and henceforth distance-weighted average of four closest texels to the exact u,v, coordinate for the texture value may be calculated (Col 1 lines 46-62) and thus, an improved texture map can be achieved.

Regarding claim 8, Rosman teaches wherein selected texel to which the target pixel is mapped and an adjacent texel are interpolated based on position of the target pixel in the selected texel. (Col 1 lines 46-62) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of bilinear interpolation of Rosman into the system of Ewins ('133) because u,v coordinate values calculated may not be exact integer values and henceforth distance-weighted average of four closest texels to the exact u,v, coordinate for the texture value may be calculated (Col 1 lines 46-62) and thus, an improved texture map can be achieved.

Regarding claim 10, Rosman teaches bilinearly interpolating adjacent texels based on the mapped position of the target pixel in the lower resolution texture array. . (Col 1 lines 18-38, Fig. 1, Col 2 lines 20-41, Fig. 3) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of bilinear interpolation of Rosman into the system of Ewins ('133) because u,v coordinate values calculated may not be exact integer values and henceforth distance-weighted average of four closest texels to the exact u,v, coordinate for the texture value may be calculated (Col 1 lines 46-62) and thus, an improved texture map can be achieved.

Regarding claim 13, Rosman teaches bilinearly interpolating the first and second texels based on a parameter that indicates the level of detail between and including texels of the higher and lower resolution arrays (tri-linear interpolation). (Col 2 lines 20-41) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of bilinearly interpolating texels of higher and lower resolution arrays into the system of Ewins ('133) because eliminating artifacts such as abrupt, noticeable changes in image sharpness that can occur as the next LOD map is selected can be achieved. (Col 2 lines 17-20)

Claims 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry. (6292193), Rosman (6184894) and Van Hook. (6353438)

Regarding claim 9, Van Hook teaches forming the sum of a first product, Uf *Tb and a second product (1-Uf)*Tc where Uf indicates a coordinate position of the target

pixel in the higher resolution texture array and Tb and Tc are adjacent texels in the higher resolution array. (Col 3 lines 8-60, Fig 1-2) It should be noted that Van Hook teaches pixel vertices (X, Y) have corresponding texture space coordinates for texel values (S,T). (Col 3 lines 17-26) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of said linear interpolation equations indicating coordinate position of Van Hook into the system of Ewins ('133) et al because a more accurate representation is produced by interpolating between four nearest samples that surround the real (S, T) location. (Col 3 lines 36-46)

Regarding claim 11, Van Hook teaches wherein a selected texel to which the target pixel is mapped and an adjacent texel are interpolated based on the position of the target pixel in the selected texel. (Col 3 lines 8-60, Fig 1-2) It should be noted that Van Hook teaches pixel vertices (X, Y) have corresponding texture space coordinates for texel values (S,T). (Col 3 lines 17-26) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of said linear interpolation equations indicating coordinate positions of Van Hook into the system of Ewins ('133) et al because a more accurate representation is produced by interpolating between four nearest samples that surround the real (S, T) location. (Col 3 lines 36-46)

Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry (6292193), Rosman (6184894) and Barenburg. (20050128213)

Regarding claim 5, Barenburg teaches for conventional mipmaping lower-resolution mipmaps are formed by averaging four texels of higher resolution mipmap

into one texel of the lower resolution version. (p. 2 paragraph 29) Furthermore Barenburg teaches in 4D (RIPMAP) mipmap arrangement a constant vertical scaling factor can be kept, for example (1,1) can be downscaled to (2,1) (vertical scaling constant resolution, horizontal downscaled by a half) (Fig. 3 p. 2 paragraphs 31-32). Therefore if traditional mipmapping is arriving at 1 texel of lower resolution by averaging four texels of higher resolution, then Barenburg teaches arriving at 1 texel of lower resolution from a pair of texels of higher resolution because one direction (vertical or horizontal) is held constant (does not change) while the other direction is downscaled by a half. (Fig. 3 p. 2 paragraphs 31-32). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of adjacent pair of texels in higher resolution is filtered to provide single texel in lower resolution as taught by Barenburg into the system of Ewins ('133) et al because only half the bandwidth for reading texels is used which also means that less texels had to be processed (p.2 paragraph 32) and thus, more memory can be saved.

Claim 4 is similar in scope to claim 5 as four adjacent texels used to derive two adjacent texels is functionally equivalent to a pair of adjacent texels used to derive a single texel and thus, claim 4 is rejected under similar scope as claim 5.

Claims 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry (6292193), Rosman (6184894) and Lin (5740344).

Regarding claim 14, Lin teaches forming the sum of a first product, Df * first blended texel and the second product (1-Df) * the second blended texel, where Df is the

parameter indicating the level of detail wherein when Df is 0, the level of detail corresponds to the lower resolution texel array and when Df =1, the level of detail corresponds to the higher resolutions texel array. (Col 4 lines 8-56, Col 5 lines 25-45, Fig.3) It should be noted that when Wv (weight of final resultant color value) is 0 then color value corresponds to lower resolution texture array (Ci) and when Wv is 1, then the color value corresponds to the higher resolution texture array (Cf) for two data arrays (Col 4 lines 8-56, Col 5 lines 25-45) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of said interpolating equation of Lin into the system of Ewins ('133) et al because some process must be provided for selecting amongst color values of each texture data point of a mipmap or rip map data array since dimensions of object surface onto which the texture data is mapped generally do not exactly equal those of data arrays (Col 4 lines 8-13) and also a relatively low computation manner of mapping texture into an arbrary sized object surface can be achieved. (Col 3 lines 9-11)

Claim 16 is similar in scope to claim 14 and thus, rejected under similar rationale. It should be noted that Lin teaches target pixel color as interpolated color value and ColorSi as color values in the Mipmap. Thus, claim 16 is rejected under similar rationale as claim 14.

Claims 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry (6292193), Rosman (6184894) and Spangler. (20040119720)

Regarding claim 15 Ewins ('133) teaches first number of texels are sampled in the first direction and a second number of texels are sampled in a second direction to form first blended pixels in the first direction and first blended pixels in the second direction and to form second blended pixels in the first direction and second blended pixels in the second direction. (p. 1 paragraph 17- p. 2 paragraph 23, p. 2-3 paragraphs 35-41, Fig. 1A) However Ewins does not explicitly teach the first number being different than the second number. This is what Spangler teaches (p. 1 paragraph 9, p. 3 paragraphs 26, 28 and 31, Fig.3) It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of a different number of samples along major axis and minor axis into the system of Ewins ('133) et al because improving quality of texture mapping where projection of a circular pixel onto texture can be achieved (p.1 paragraph 8) and also there is no need to send a blend factor for subpixels to the end of the pipeline that indicates how much contribution outer subpixels have, thus further minimizing costs. (p. 3 paragraph 35)

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ewins (20020126133) in view of Ewins ("Mip-Map level selection for Texture Mapping") in further view of Perry (6292193), Rosman (6184894) and Lin (5740344) in further view of Burrell. (2001/0048443)

Claim 17 is similar in scope to claim 16 except for the recitation of blended Color blended according to function ColorSi for u = 0 to 3 and v = 0 to 3 (4 by 4 sampled texture). Burrell teaches a 4 by 4 pixel texture with sampled color values. (p. 3 paragraphs 31-32, p. 4 paragraph 73- p. 5 paragraph 77) It would have been obvious to

one of ordinary skill in the art at the time the invention was made to combine the teachings of a 4 by 4 texture array with sampled color values into the system of Ewins ('133) et al (utilizing the interpolation equation of Lin) because an efficient transformation of textures from their initial state to final state, transferring a controlled amount of graphics data from one computer system to another (p. 1 paragraphs 8-9) can be achieved.

Allowable Subject Matter

Claims 12 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin K. Xu whose telephone number is 571-272-7747. The examiner can normally be reached on 8:30AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman can be reached on 571-272-7653. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KX

Kevin Xu

7/2/07

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